**Blue Ribbon Panel to Review the Use of Oxygenates in Gasoline**
**Draft Meeting Minutes**
**May 24 – 25, 1999**
**Wyndham City Center Hotel**
**Washington, D.C.**

## Introduction

Dan Greenbaum (Health Effects Institute) opened the fifth meeting of the Blue Ribbon Panel to Review the Use of Oxygenates in Gasoline. He thanked the Panel members for providing comments in such a timely manner on the options and issues summaries that were distributed prior to the meeting. Mr. Greenbaum stated that the majority of this meeting is reserved for the Panel to discuss the options. Mr. Greenbaum noted that his goal for the meeting is threefold and involves: (1) discussing the issues summaries and developing a plan to finalize them; (2) fleshing out in detailed Panel discussions what constitutes water protection; and (3) discussing the programmatic options and beginning to craft language that can be refined and distributed to the Panel before the next meeting. The majority of time at the next meeting will be spent discussing and refining the draft report. Panel members agreed to this approach. Next, Mr. Greenbaum asked the Panel for comments on each of the issue summaries that were distributed prior to the meeting. Panel member comments on the issue summaries are arranged below according to the five issue summary topics:

1. Air Quality Benefits;
2. Water Contamination;
3. Comparing Fuel Additives;
4. Fuel Supply and Price; and
5. Treatment/Remediation/Prevention.

### *Air Quality Benefits Issue Summary*

The following section includes comments from and questions asked by the Panel regarding the Air Quality Benefits issue summary.

- Additional work is needed on the conventional gasoline section since two-thirds of all national gasoline falls within this category.

- In the section that addresses overcompliance of toxics, it is assumed that the benzene level will stay at .68 and does not take into account the fact that the cap could be decreased.

- In order to produce the same amount of gasoline the summary misstated that as methyl tertiary-butyl ether (MTBE) in gasoline is decreased, benzene will have to be increased. If MTBE is removed from gasoline, from a volume standpoint, something must replace it. However, it cannot be assumed that refiners will replace MTBE with benzene. The summary should clarify that the two-thirds reduction associated with oxygenated reformulated gasoline (RFG) assumes a one percent cap of benzene.

- Analysis of the Chicago and Milwaukee data indicate that sulfur was the primary factor influencing relative volatile organic compounds (VOCs) and nitrogen oxide ($NO_x$) performance, and that it had some influence on toxics performance. The term "some" in this statement should

be quantified, because another section of the summary indicates that there is no impact with regards to sulfur.

- An important issue is the extent to which air quality benefits can be maintained. Certain benefits have been seen that are greater than required by the legislation. The Panel has been asked to look as the effectiveness of a regulatory mechanism in a vacuum, and is limited in determining how the effectiveness of other regulatory mechanisms relate to each other. This is a challenge that the Panel must address by attempting to bring all the pieces together.

- It is true of every rule that has ever been written, that someone always has the ability to do better than required. But, a standard is needed, and regulations should not mandate below the standard just because it is achievable.

- The way the issue summary explains how to calculate the national average of gasoline is incorrect. Rather than averaging the fuel, emission reductions should be calculated area by area and then the reductions should be averaged.

- It is fundamental to determine the baseline that is being used. From a public health point of view, health effects are critical. If it is determined that emissions reductions can backslide because overcompliance is wrong, it must be ensured that health/resource concerns are not being traded off against other concerns.

- For all the issues summaries in general, the use of oxygenates is often viewed as mandated or not mandated, without consideration for what the world looked like prior to the RFG gasoline programs, with gasolines containing 2-8 percent oxygenates. The majority of discussions focused on either having the mandate or eliminating ethers; however, it is important to understand and consider that having a small amount of MTBE in the fuel supply might provide the octane that would greatly diminish the risk of having to push aromatics back into the fuel.

- The statement on page 9 of the air quality issue summary that the additional cost of producing RFG is difficult to justify for areas that do not have significant air quality concerns must reflect a very narrow definition of air quality concerns because there are a tremendous number of places that have air quality concerns that derive mostly from gasoline. It would be beneficial if the summary could include information on air toxics that can be provided from the Cumulative Exposure Project (CEP).

- Concern was expressed over the reference on page 9 to "one national RFG program." This phrase implies that the California program will cease to exist.

- The paragraph on page 3 that discusses carbon monoxide (CO) emissions seems to give a heightened sense of importance and worth to the CO benefits. It was clarified that this paragraph refers to the CO problem and not the CO contribution to ozone.

- It would be extremely beneficial to include in the summary references to where the data came from to clarify that an analysis was conducted and the statement is not just an opinion.

- Regarding the chart on page 2, it would be helpful to include a range of percentages as opposed to just an average, which can be misleading.

***Water Contamination Issue Summary***

The following section includes Panel comments on the Water Contamination Issue Summary.

- The appropriate data should be analyzed to determine whether there is a different level of concern over MTBE in ground water when considering lower levels of MTBE as opposed to the MTBE in gasoline at 11-15 percent by volume. This may help determine whether it is necessary to have zero percent MTBE in the fuel supply in order to see significant improvements in water quality. The petrochemical industry should have the available data to determine the amount of MTBE used on a regional basis, and possibly on a national basis. Total production volume data of MTBE should exist and should be examined.

- There are data that indicate that in Suffolk County, Long Island, 86 percent of the wells tested positive with a detection limit of .5 ppm. It was also noted that Nassau and Suffolk County, Long Island, have stricter laws than the federal regulations. It would be interesting to see if there is a link between upgraded systems and contamination.

- In the section of the issue summary that addresses states, the differences among states needs to be blocked out and made more specific because it creates an unfair advantage. The numbers provided appear to be very irregular. In response, it was noted that preliminary drinking water advisories were distributed at different times and, therefore, states adopted things at different points in time. The states will be contacted to clarify the issue.

- Item 3 of the issue summary is a little vague in the wording. For example, it should be expanded to explain that there are tiers of reasons why the wells were closed instead of just saying that the closures were a result of public reaction.

- It would be beneficial to integrate the chart on page 2 with the result of contamination in RFG- and non-RFG areas to determine if there is any connection to support item #5 on page 4 "Contamination in RFG vs. non-RFG areas." This might support the discussion of the differential impacts of MTBE in different places. Arsenic and radon are also common substances found in water. If the summary only focuses on MTBE, the fact that many other substances are commonly found in water is lost. Therefore, it would be beneficial to add a paragraph to put the issue in context.

- Benzene should be added as a benchmark because it has been very widely used and distributed.

- Because the table on page 2 is provided for the purposes of making broad comparisons, the number of decimal places be should be reduced.

***Comparing the Fuel Additives Issue Summary***

This section provides Panel comments on the Comparing the Fuel Additives Issue Summary.

- The section regarding health effects of alkylates on the bottom of page 6, seems to imply that alkylate has a high Reid vapor pressure (RVP), when in fact the reverse is true and a benefit would be seen. If alkylate use is increased, an adjustment in the formula may be needed, but RVP may not be the driving force.

- The commingling section should be integrated with the air quality section on commingling to provide cohesiveness. Also, it should be quantified that ethanol, as a neat fuel, is a very low volatility fuel; therefore, when a volatility increase in gasoline is discussed, a range should be specified because currently, the statement that ethanol raises volatility in gasoline is not accurate in regard to all blends.

- The summary indicates that the most likely replacement for MTBE is alkylates; however, this should be clarified because there is not enough evidence to support this claim.

- There are a number of substances that would replace MTBE if it is banned, including ethanol.

- When comparing gasolines, the gasolines do not have similar octane numbers.

- It is hard to predict what will happen if MTBE is banned. The likelihood is that the gasoline pool will be composed of gasolines with a lower octane. Also, the effect this will have on the driveability index of gasoline and the response of auto makers to this change needs to be determined.

- It has been arbitrarily stated that there is a need to maintain everything, including driveability, clean air, etc., which may be a constraint that should not be dealt with. However, if constraints are not maintained, too many variables will be involved and no impact can be determined. It is important to determine the intersection between the likelihood that aromatics will increase in some versions of these blends and what effects that will have on fuel.

- In response to a question as to whether tert-butyl alcohol (TBA) is used as a cosolvent in blending ethanol in gasoline, it was noted that some commingling for the purposes of blending is allowed, but at very low levels.

- In response to the rumor that in the process of making alkylates, MTBE can be a by-product, it was noted that there is no way that MTBE can be produced as a by-product of alkylates.

***Fuel Supply and Price Issue Summary***

The following section includes Panel comments on the Fuel Supply and Price Issue Summary.

- The second bullet on page 1, under supply, does not correspond with the table in the back. Page 1 indicates that the total amount of oxygenates used equals 370,000 b/d of which 270,000 is MTBE, 90,000 is ethanol, and 10,000 is other. In the control areas, those data do not correspond to the table in the chart, which shows that 40,000 b/d of ethanol is used in oxygenated gasoline and RFG. It is important to note that the other 40,000 b/d are used for other purposes, including octane. If in fact, MTBE is removed from gasoline, ethanol use will have to increase from 40,000 to 175,000, which leads to the significant construction of new plants. The ability to produce that amount of ethanol was questioned.

- Concern was expressed about the comments regarding timing in the summary. Although four years is adequate to build a unit, the process of obtaining permits and the time it takes for the regulations to change may take longer than four years. Also, the cost numbers from California do not take into consideration the effect if MTBE is phased-out nation-wide.

- Specific comments were provided by NESCAUM to correct the wording regarding fungibility.

- The summary should note that, although models are important qualitative tools, models should not be used to assert exact outcomes.

- An inadequacy of the analysis to date is that there are no data to determine the toxics, price, and costs impacts of scenarios without oxygen use.

- An inconsistency was noted regarding the potential interruption of supply and timing. Timing and state consistency issues need to be examined and an additional analysis to balance the two should be considered.

- It was noted that the in the scenario of maintaining the oxygenate mandate and banning MTBE, ethanol usage will most likely increase given the two options that involve: (1) an oxygenate mandate without MTBE; and (2) without an oxygenate mandate and some use of ethanol and non-oxygenate mandate.

- It was stressed that ethanol use is not a midwest phenomenon; it is marketed nationally.

- Although there is confidence that enough ethanol can be produced, the general consensus is that, while any switch will require change, a switch to ethanol will require larger infrastructure changes. It was suggested that a state that uses RFG be selected and a cradle-to-grave analysis of a switch to ethanol be examined. Regarding the timing issue, it would be useful to produce a flowchart beginning when the clock starts through the transition.

- There are problems with the wording that leave a greater sense of the actual do-ability, reliability, and sensibility than actually exists.

***Treatment/Remediation/Prevention Issue Summary***

- Remediation of leaking underground storage tank (LUST) sites versus treatment of water contamination should be separated within the summary because they are very different challenges. Triage of these sites should also be considered.

- Regarding funding and the discussion of the Safe Drinking Water Revolving Fund and the Clean Water State Revolving Fund on page 2, the summary should emphasize that both of these funds have monies available that states can receive in the form of grants.

- The issue of treatment versus remediation is combined throughout all of the sections. The summary would benefit by strictly separating all discussions regarding treatment and remediation.

- Regarding the national assessment, it would be helpful to speculate on the total national costs of the total treatment requirements.

- The summary should stress source water protection. There are a host of things that can be done prior to prevention/remediation efforts. In addition, the summary should contain a stronger section to capture the work that has been done regarding delineations.

- The summary could generally mention clean-ups, and then address the limitations of pump and treatment, as well as their effectiveness on underground releases; not just USTs. Also the summary should mention the question of natural attenuation, which allows the differences between benzene, toluene, ethylbenzene and xylenes (BTEX) plumes and MTBE plumes to be identified.

- In order of importance, the following issues should be addressed: (1) prevention (e.g., why tanks are leaking or how much they are leaking); (2) prevention in terms of land use planning (e.g., vulnerable areas); and (3) how to handle the problems that already exist.

- Regarding LUSTs, a proper program involves not only replacing the necessary equipment, but also inventory management, which is not nearly as expensive as replacement options.

- The three goals of the LUST program include: (1) preventing leaks; (2) early leak detection; and (3) addressing every release in the most appropriate manner possible. Inventory management has been identified as a problem in the program.

Mr. Greenbaum concluded the discussion by assembling a subgroup of the Panel to work with the authors of the summary to incorporate the necessary revisions. The subgroup was led by Carol Henry (with Karen Smith as her point of contact) with participation from Anne Happel, Mark Buehler, John Zogorski, Sammy Ng, and Cynthia Dougherty.

**PRESENTATIONS**

**Fate and Transport of Ethanol in the Environment**

Michael Kavanaugh and Andrew Stocking of Malcolm Pirnie delivered a presentation to the Panel that summarized the findings contained in a report prepared for the American Methanol Institute, which evaluated the fate and transport of ethanol in the environment. The purpose of the report was to summarize the scientific literature on the fate, transport, treatment, and toxicity of ethanol in air, soil, groundwater, and surface water as a result of its use as a fuel oxygenate. The study addresses the environmental persistence of ethanol, and the impact of ethanol on water resources. Also included in the report is a summary of the literature describing the advantages and disadvantages of using ethanol to meet fuel oxygenate requirements.

Mr. Stocking explained that 94 percent of ethanol is produced from corn fermentation and must be denatured prior to use. In 1998, 15 percent of all oxygenated gasoline contained ethanol. Ethanol is a highly mobile small chain alcohol with an infinite aqueous solubility. It has a tendency to adsorb moisture when in contact with air. Relative to other oxygenates such as MTBE, ethanol has high oxygen content and heat of vaporization, and low air/water and soil/water partition coefficients. Mr. Stocking further explained the comparative properties of ethanol and other gasoline additives, such as MTBE and benzene, as well as the significance of these properties, including aqueous solubility, vapor pressure, Henry's constant, octanol/water partition coefficient, biodegradability, reactivity, and structure.

Next, Mr. Stocking explained the report's evaluation of the fate of BTEX gasoline components in groundwater in the presence of ethanol. The purpose of this aspect of the study was to determine the likely increase in BTEX plume length due to the presence of ethanol in a gasoline release. The results of these analyses indicate that typical BTEX plumes in California and Texas travel no further than 300 feet

from the source. However, the addition of ethanol to gasoline may extend BTEX plumes by 25 to 40 percent, although, areas with higher ethanol concentrations would suggest an increased effect.

Mr. Stocking stated that the conclusions of the study report that, in ground water, ethanol levels depend upon the nature and magnitude of the release. Because ethanol is totally miscible in water, all of the ethanol in gasoline will partition into the water phase. Depending upon the level of dilution, ethanol levels in the ground water can exceed 50,000 mg/L. Probable levels in the vicinity of an ethanol-blended gasoline spill range from 400 to 4,000 mg/L. In addition, ethanol will rapidly biodegrade following release to the environment, but may also cause rapid depletion of electron acceptors and a suspected interference with hydrocarbon biodegradation. Ethanol is preferentially biodegraded compared to other gasoline constituents (e.g., benzene, MTBE). However, if ethanol enters a drinking water supply, ex situ remediation will be difficult.

Finally, Mr. Stocking outlined the data gaps and unknowns that still exist surrounding this issue. For instance, a study has been recently initiated by the MTBE Research Partnership to determine the occurrence of ethanol in water in states using gasohol. In addition, further studies have begun to analyze the impact of ethanol on BTEX plumes in terms of cosolvency and plume elongation. Gaps that require further study include the impact on costs of site characterization and remediation, the impact of ethanol on MTBE plumes, the toxicity of ethanol in a source area, and the treatment of ethanol-impacted drinking water.

***Panel Discussion***

- The relationship between ethanol cosolvency and benzene concentration is linear and potentially even greater when played out with greater cosolvency. The model did not take into account cosolvency because cosolvency is not assumed to drive the issue.

- It is necessary to keep the solubility of neat compounds and the solubility of ethanol separate. It is important to note that the cosolvency effect may not be as important at all sites.

- Because ethanol biodegrades rapidly and MTBE does not biodegrade as fast, ethanol would not move out in front of BTEX components because it is so soluble and then disappear to allow BTEX to biodegrade. In addition, oxygen is being used up, so while ethanol may move ahead of BTEX initially, it is a small part of the plume.

- In the field, a Borden study showed consistent values with those heard in the presentation; the benzene plume was 18-25 percent larger than the other two plumes. However, quantifying the exact length is more difficult.

- Regarding the implied toxicological effect of the rapid reduction/biodegradation of ethanol, it was noted that in the plume area and at the source area, the reduction of concentration is due to dilution.

- It was noted that the taste and odor threshold of ethanol (at 1 ppm) is much higher than MTBE.

- Regarding the point at which remediation efforts should be conducted (unless a direct release occurs in close proximity to drinking water wells) ethanol remediation is probably not required.

- In terms of whether soil varieties effect ethanol degradation, the more organic the compound, the faster its degradation rate.

- Regarding denaturants and what they do to ethanol, the Bureau of Alcohol, Tobacco, and Firearms adds denaturants to gasoline to make it poisonous and, therefore, non-drinkable.

- Regarding the remediation/monitoring of leaking tank sites, ethanol cannot be measured using the same standards as BTEX.

**Alkylates: Key Components in Clean-Burning Gasoline**

Mr. Kenneth Dexter Miller of DeWitt and Company Incorporated was unable to attend the meeting due to weather conditions and, therefore, delivered his presentation on the role of alkylates in gasoline via teleconference. Mr. Miller's presentation on "Alkylates: Key Components in Clean-Burning Gasoline" began by explaining the historical development of gasoline production from 1925 through the 1980s, including the presentation of a chart illustrating that the increased use of gasoline and crude in the U.S. since 1920. Mr. Miller explained that the structure of gasoline production today is governed by ASTM Specification D 4818 and the Clean Air Act. There are eleven significant blendstocks that refiners use to make gasoline; each has unique properties of octane, etc. Reformate and catalytic cracked gasoline accounts for 67 percent of all gasoline produced, while alkylates have 14 percent of the market. Refiners can blend gasoline in many ways, but they must always meet octane, RVP, boiling point, oxygen, aromatics, olefins, and sulfur levels.

Mr. Miller explained that alkylate is a side-branched hydrocarbon that is produced by reacting $C_3$ and $C_4$ olefins with isobutane. 1.7 gallons of alkylate are produced by reacting one gallon of isobutylene with 1.13 gallons of isobutane. It was noted that when mixed butylenes are fed into the reaction, a similar process takes place. The overall octane for mixed feed is about 94.5 versus 100 for pure isobutylene feed. As produced in a refinery, a typical alkylate contains approximately 26 percent isooctane and about 25 percent of other alkylated octanes. Olefins are produced by the catalytic crackers and have a limited range for expansion. Most refiners have alkylate capacity matching the catalytic crackers.

Next, Mr. Miller explained that California consumes 915,000 b/d of gasoline, 435,000 of which is reformate, 168,000 which is catalytic cracked gasoline, 165,000 which is alkylate, and 99,000 of MTBE. Refiners in California have limited possibilities for alkylate increases and would be hard pressed to replace the lost volume. Refiners elsewhere in the U.S. have about the same yield structure as in California and are full with respect to alkylate capacity. In addition, U.S. refiners cannot produce any extra alkylate for California, and will have volume problems if MTBE is banned in the U.S.

Mr. Miller then provided potential sources of additional alkylates or similar blendstocks. For example, MTBE plants could be converted to make alkylate, which would be very expensive. MTBE plants could be converted to make isooctane, which is less expensive, but still expensive. Or, raffinates, which are a $C_4$ stream that has 23 to 30 percent isobutane, from olefin plants could be used; however, there are other uses for the $C_4$ stream, and manufacturers may not see the benefit in converting their plants. Mr. Miller stated that the capital cost from converting MTBE plants to make alkylate would be approximately $1.1 billion by the year 2007, and converting MTBE plants to make isooctane would cost $385 million.

In conclusion, Mr. Miller stated that alkylates are excellent blendstocks and widely used for gasoline. Alkylates have high octane components (92-94) and very small contents of olefins, aromatics, and sulfur. However, the opportunities for expanded use are limited. In addition, Mr. Miller stated that alkylates are

inferior to MTBE in clean-air gasoline because they are 10-15 octanes lower, have higher T10 and T90 points (which brings the driveability index into question) and they have no oxygen. Ethanol is also limited and has a slightly lower octane and the dilution effect is smaller because of the increased oxygen content. In summary, Mr. Miller stated that a total loss of MTBE outside of California would require drastic reductions in RFG quality.

***Panel Discussion***

- Clarification was requested on the criteria (e.g., air quality, driveability) that was used to conclude the statement that alkylates are inferior, and the nation will be in an inferior position if a switch is made to alkylates. Mr. Miller stated that alkylates have an octane of 92-94 while MTBE has an octane of 110; consequently, the equivalent amount of MTBE blended into the gasoline will provide more reduction in aromatics and raffinates than would be possible with alkylates.

- Further clarification was requested on the assumptions that went into developing the timetable for new products if MTBE plants are shut down. Mr. Miller stated that there are eight major MTBE plants in the U.S. The first date provided is a result of the reaction of industry to the loss of California, which will cause 3-4 MTBE plants in the U.S. to shut down. After that, the question becomes to what degree does MTBE fall into disrepute elsewhere in the country. In addition, the timetable was developed on the assumption that in 2007 all of the industry will have to convert to something other than MTBE.

- Regarding the use of the terms "expensive" versus "very expensive" in the slide that discusses potential sources of additional alkylates or similar blendstocks, it was questioned whether the slide assumes that, although conversion is so expensive that it is hard to justify, those conversions will be made regardless?

- It was noted that there is some capacity for alkylates, but much of it is currently utilized for gasoline production. Therefore, questions were asked about the cost to expand U.S. alkylate capacity if MTBE was phased-out. Mr. Miller stated that the amount of additional material required would be substantial, and the issue would have to be looked at carefully.

- Mr. Miller concluded the discussion by stating that he will provide a complimentary copy to the Panel of a multi-client study, prepared by DeWitt & Company Incorporated, that covers the entire MTBE issue in great detail.

**Alkylates: Environmental Issues**

Philip Gschwend from the Civil and Environmental Engineering department at the Massachusetts Institute of Technology provided the Panel with a presentation regarding the possibilities of other chemicals replacing MTBE if a one-to-one switch had to be made. Dr. Gschwend addressed four issues in his presentation, including: (1) what chemicals are we talking about?; (2) how should we examine environmental "issues?"; (3) the case of leaking underground storage tanks with regard to partitioning from gasoline into water (and air), retardation of subsurface transport, and (bio)degradability; and (4) "toxicity."

To address these issues, Dr. Gschwend began with a chart illustrating the relationship between the number of carbon atoms in a molecule and the octane number. Dr. Gschwend stated that to begin

evaluating a chemical environmentally, the overall fate of the chemical (transports and transformations) must be evaluated to determine the final exposures. Physical properties of a chemical are needed to estimate transport; these are generally available or readily estimated from chemical structure. Dr. Gschwend presented a graph illustrating that the smaller the molecule the higher the solubility and vapor pressure. In addition, the structure of a molecule also effects the solubility and vapor pressure. Next, Dr. Gschwend explained that concentrations of compounds in water adjacent to spilled gasoline (assuming that all the compounds are perfectly compatible with gasoline and are present in gasoline at ten percent) are equal to 0.1 aqueous solution. This same data can be used to derive retardation factors. Dr. Gschwend also explained that the more branched a hydrocarbon the more persistent in teh environment and the slower the biodegradation process.

Dr. Gschwend also provided a graph that plots the hydrocarbon concentration necessary to cause a 50 percent reduction in photosynthesis against solubility, which can be used to identify the approximate concentration that is needed to stop photosynthesis in photoplankton. In summary, Dr. Gschwend stated that investments should be made in "preview calculations" to anticipate the exposures via air, water, etc. for individual alkylate components. This process is not very difficult if the chemical compositions are known. In addition, biodegradation will be the least understood, but most important parameter. Furthermore, "problems" beyond human toxicities (e.g., pheromone use disruption) are toxicities due to mixtures, and are causes for concern.

***Panel Discussion***

- Regarding the biodegredation issue, what is the significance of the difference of branch chains versus straight chains in the isobutane case? In response, Dr. Gschwend stated that the data are available and should be analyzed to determine the significance.

- In response to a question regarding how the conceptual model of partitioning will change when the colloidal transport of organic transports in groundwater is considered, Dr. Gschwend stated that in some cases it is possible to have small particles that do not settle, which can carry along pollutants that do not degrade.

- Regarding biodegradability, petroleum is a huge mix of compounds, which are not regulated in the same way and not targeted in the same way as BTEX compounds and MTBE. Therefore, petroleum is left at sites that get cleaned up or shutdown. Petroleum is not regulated or targeted in the same way as BTEX or MTBE.

**National Academy of Sciences Report on the Ozone-Forming Potential of Reformulated Gasoline**

William Chameides and Armistead Russel, of the Georgia Institute of Technology, delivered a presentation on the National Research Council's (NRC's) report on the ozone-forming potential of reformulated gasoline. They explained that the NRC is an operating arm of the National Academy of Sciences and is a non-profit, non-governmental entity that provides science and technology advice. The NRC is not funded by Congress, although it does have a Congressional charter. The NRC consists of various committees of experts, and each product developed is subject to a peer review process. It was noted that the peer review comments are held as privileged information.

Dr. Chameides began his presentation by explaining that the task of the NRC was to asses the use of ozone-forming potential (reactivity) for evaluating and comparing motor vehicle emissions resulting from the use of different blends of RFG. The NRC was also tasked to consider the potential impacts of

using a reactivity approach on expected air quality benefits of the RFG program, including reduction of VOC, $NO_x$, and air toxics emissions, as well as reduction of ozone formations. Specifically, the task focused on the use of oxygenates in RFG, with specific attention to MTBE and ethanol. Dr. Chameides stressed that the charge was very narrowly focused and did not address: design and implementation of possible new regulations based on ozone-forming potential of RFG; domestic sources versus foreign sources of fuel; relative energy and cost implications for production of different RFG blends; relative health and global environmental impacts; use of renewable versus nonrenewable fuels; emissions resulting from production, storage, and distribution of various RFG blends; emissions from non-road vehicles using RFG; and effectiveness of oxygenates or other substances for enhancing the octane-value of RFG blends.

Next, Dr. Chameides explained the topics of the Committee's major findings and the corresponding conclusions of the NRC report. Conclusions were presented on the following topics:

1. Ozone-precursor emissions from gasoline-fueled vehicles;
2. High-emitting motor vehicles;
3. The use of reactivity in assessing the ozone-forming potential of emissions;
4. Relative reactivity as a means of comparing fuels;
5. Reactivity of carbon monoxide emissions;
6. Overall air quality benefit of RFG;
7. Effect of oxygenates in RFG;
8. MTBE blends versus ethanol blends – exhaust emissions;
9. MTBE blends versus ethanol blends – evaporative emissions;
10. Reid vapor pressure of ethanol-containing fuel;
11. Use of reactivity to evaluate RFGs;
12. Models used to characterize emissions from RFG blends; and
13. Opportunity to track the effects of Phase II RFG program.

Dr. Chameides concluded by reiterating that it is difficult to attribute a significant relationship between the apparent downward trend in ozone and the use of RFG, and that the presence of oxygen appears to have little effect on the ozone forming potential of gasoline. Therefore, the RFG program may be a strategy that, although it may not have a negative effect, may not necessarily have a positive effect on air quality.

***Panel Discussion***

Jason Grumet, NESCAUM, commented that he was troubled that the careful caveats that were included in Dr. Chameides' presentation were absent from the mass media and the press release. Mr. Grumet explained that the report effectively answered questions so narrowly that it set the debate back and caused much of the public to interpret very broad assumptions. Dr. Chameides responded that the NRC was tasked to perform a very specific task, which they did and fulfilled their obligation. He stated that the press release was factual and contained all the caveats. Dr. Chameides suspects that the public reaction to the press release was a result of the fact that it contained some very important information that the public was not previously aware of.

Margo Oge, EPA, stated that the NRC was asked to address a set of very specific technical questions that EPA believes were appropriately addressed. However, the NRC was not asked to provide any advice on the benefits of oxygenates or RFG. She noted that the statement in the press release that oxygenates do not improve air quality misinformed the public. The public had to read the report very carefully to

understand that it did not say that oxygenates do not impact air toxics. Dr. Chameides stated that the charge was to address a set of technical questions in the context of whether such an approach would have an impact on the expected impacts of RFG on air quality.

Todd Sneller, Nebraska Ethanol Board, stated that he was struck by the positive results provided by Dr. Chameides in his presentation given the negative reaction to the news releases by air quality regulators. He stated that he was surprised that the number of benefits and positive results contained in the report were not emphasized and relayed to the public in the releases. Mr. Sneller also noted that Dr. Chameides mentioned as a caveat that only very small benefits could be attributed to the reductions seen and, therefore, dismissed as insignificant. However, Mr. Sneller commented that small benefits reductions are extremely important in many areas of the country. Dr. Chameides stated that the NRC did not know the effect of increased RVP on emissions. Dr. Chameides stated that the NRC looked at state monitoring data and, in every report found logical disconnects or flaws that caused them to question the results.

Questions were raised regarding the uncertainty that exists regarding high emitting vehicles due to the lack of data. Robert Sawyer, University of California at Berkeley, questioned the extent of the problem given that the two tools that will be used heavily in establishing the formulation of new RFG will be the predictive and complex models, both of which have very little data relating to high emitting vehicles. Dr. Chameides stated that the extent of the problem is unknown and the report indicates that this issue requires further study.

Dr. Sawyer questioned how (given that the baseline used in the study was EPA's inventory for replacing motor vehicles in perspective of the total emissions) the report's conclusions will be affected if it is determined that the baseline is off by a factor of two. Dr. Chameides stated that even if the baseline is off by a factor of two, the size of the benefit with regard to RFG, and the size of the response of ozone to a change in precursor emissions will not substantially effect the conclusions reached. The effect would be incremental and would not change the findings on oxygenates.

Ron White, American Lung Association, requested more background on the statement that some data suggests that oxygenates can lead to higher $NO_x$ emissions, which is contradictory to what some models have shown. Dr. Chameides responded that it is important not to confuse the RFG program with oxygenates. It is likely that gasoline with oxygen has decreased $NO_x$ emissions; however, given the NRC's task of hypothesizing two identical gasolines with the exception that one has oxygen, there was some data to suggest that adding oxygen might enhance $NO_x$ emissions. Mr. Russel added that in California's predictive model, as oxygen content is increased, an increase in $NO_x$ emissions is also seen. Ms. Oge stated that the NRC obtained some of their data from the auto oil study; however, EPA has surveys of refineries and statistics on what is produced in the marketplace and, although for Phase I there is no requirement to reduce $NO_x$, these data show a slight decrease in nitrogen oxides.

Mr. McNutt stated that he was troubled by the fact that the report comes to all of its conclusions without looking at the real quality of gasoline being blended and sold in the market, which is absolutely influenced by the presence of oxygenates, positively or negatively. He stated that a lot of data exists on the real quality of gasoline and it is the role of oxygenates and how it influences the real quality of gasoline that influences the real emissions of vehicles and, therefore, judgements cannot be made on the role of oxygenates without looking at the real quality of gasoline. In addition, the report makes statements that are factually incorrect. For example, RFG cannot be blended with ethanol with a vapor pressure one pound higher. Furthermore, DOE was involved in development of the federal complex model, which provided large amounts of data on high and super high emitter classes; these should not be viewed as outliers as the report indicates. Dr. Chameides stated that the report does not state that high

emitters were not in the complex model; however, it was noted that they were not well characterized in terms of the RFG effect on high emitting vehicles. There are still major problems in understanding what causes high emitters and what are the types of high emitters; therefore, by definition, there is probably large uncertainty in the characterization of those emissions in models such as the complex model.

Mr. McNutt stated that, although it is easy to say that all models have problems because they are statistical estimates, the report should have indicated the direction in which the problems might exist (e.g., overestimating, underestimating). Dr. Chameides stated that the findings were based on the fact that the data are contradictory.

In response to the discussion of high emitters, Mr. Greenbaum stated that Dr. Chameides alluded several times to absence of data or its existence only in the "gray" literature; however, the report states that an important finding of remote sensing measurements is that most overall CO and VOC emissions and the reductions in these emissions from the use of RFGs are associated with emissions from high emitters and more specially from vehicles with malfunctioning emissions controls. The report then cites 11 studies to support this claim. Dr. Chameides stated that remote sensing data cannot be used to quantify the impact on different types of gasoline formulations. Remote sensing can only be used to determine what kinds of vehicles are giving what kinds of emissions. When referring to the complex model, data from test vehicles are used to estimate the emissions from the fleet, which is very different than identifying a high emitter.

Mr. Sneller stated that, regarding high emitters, he believes there were significant findings that should have been highlighted in the report. He provided a document for the record entitled "Reformulated Gasoline Effects on Exhaust Emissions: Phase I: Initial Investigation of Oxygenate, Volatility, Distillation and Sulfur Effects" that was developed by SAE and goes thorough a number of parameters and makes useful comparisons.

In response to a question from Mr. McNutt regarding what the NRC thinks is the relevant scientific information to the issues being explored by the Panel, Dr. Chamedies stated that there appears to be a significant downward trend in ozone that is most likely reflected in emissions controls in one or more ozone precursors. If asked is it necessary to have oxygen to effect ozone precursors, he would state that the effect is small. However, Dr. Chameides stated there is also little evidence that oxygenates have a negative impact on ozone precursors.

Dr. Sawyer stated that the NRC report discusses $NO_x$/VOC ratios, but that issue is not discussed in any of the conclusions; therefore, Dr. Sawyer questioned whether there are geographical differences that affect the NRC's conclusions. Dr. Chameides stated that RFG in principle reduces $NO_x$, VOC, and CO emissions. It was the consensus of the committee that RFG will help everywhere, and because the committee saw very little impact of oxygenates on ozone precursor emissions, it is unlikely that it would vary from region to region.

Mr. McNutt asked whether it would be fair to say that the committee makes the distinction between oxygen in RFG as a chemical formulation and oxygenates in RFG as a engineering blendstocks? Dr. Chameides agreed to the distinction of oxygen versus oxygenates.

Ms. Oge stated that the RFG program has two basic requirements: (1) reduce precursors to ozone; and (2) reduce air toxics. The discussion has focused on the benefits of oxygenates in reducing air toxics. The NRC report did not go into a lot of detail to estimate by how much air toxics have been reduced as a result of using oxygenates.

Mr. White asked how Dr. Chameides' statement that RFG has contributed to the ambient reduction in ozone that has been seen, but cannot contribute that reduction to the oxygen content, is consistent with the reports statement that "it is difficult to attribute a significant relationship between the apparent downward trend in ozone and the use of RFG," which suggests that you did not find a contribution of RFG to the reduction of ambient ozone. Dr. Chameides stated that: (1) in general, if there is a ten percent reduction in total VOC emission, it might be expected to result in a two percent ozone reduction; it is not a one to one relationship; (2) when referring to 20 percent emissions from motor vehicles, and motor vehicles contribute 40 percent to the total VOC emissions, 20 percent of 40 percent equals an eight percent reduction in total emissions. Given that and that ozone has been decreasing over the past decade, the ozone trend cannot be analyzed and it cannot be stated that this part of the trend is due to RFG. Mr. White stated that unfortunately the take home message of the report is not that the contribution cannot be quantified, rather there is no contribution of RFG to the downward trend in ozone precursors.

Bob Perciasepe, EPA, stated that the same dilemma is true for every strategy for reducing the precursors of ozone. The processes involved at the state and local levels, as combined with the national program, must be analyzed to determine how they cumulatively reduce the precursors. But, attempting to tease out the exact contribution of one part of that downward trend as opposed to its role in the cumulative effort is difficult. EPA fully recognizes that the progress made is the result of cumulative impacts from many strategies.

**Panel Working Session on Options**

Mr. Greenbaum distributed the draft results of the Panel members ratings of the initial options from the April meeting. Mr. Greenbaum stressed that the ratings provided were not a final "vote," but rather a discussion tool to help guide panel deliberations. Mr. Greenbaum next provided a consolidation of the ratings that illustrated the average score for each option by air quality, water contamination/protection, fuel quality/supply/price, and health effects. The matrix also provided the total score for each option, as well as the range of scores and comparative ranking. Mr. Greenbaum suggested that the Panel spend time discussing: (1) how to assure air quality benefits?; and (2) how to assure the highest certainty of water quality? Mr. Greenbaum asked the Panel to identify pieces of the options that they can broadly agree on in an attempt to determine if it is possible to develop one or two sets of hybrid options, which can then be crafted into draft language for the Panel to review. Mr. Greenbaum also asked the Panel to consider whether there were any recommendations missing that should be included in the list of options. Panel comments included:

- Include more options within the "other" category;

- Given the results of the ratings, there appears to be four overall key issues that the Panel should consider and address:

    1. How to enhance and improve water protection programs?;
    2. Do you increase flexibility or maintain the mandate?;
    3. Do you phase down MTBE or take it to zero (no MTBE allowed at any level)?; and
    4. What do we mean by "strengthen air quality regulations?"

- Must decide whether or not the winter-time oxygenate program should be taken off the Panel's agenda.

- Regarding the phrase "strengthen air quality regulations," it was thought that if more flexibility in performance standards was created, less backsliding would result. The Panel should argue for programs that will ensure that emissions do not increase, while being as least intrusive as possible. Regarding RFG, the Panel would like to maintain the benefits that have already been gained.

- Regarding the backsliding issue, it is important to quantify what a no backsliding amount is and whether or not that amount is significant or insignificant. If emission reductions were allowed to increase slightly in order to provide clean water (and the emissions increase is not significant) then some backsliding might be considered.

- Because Congress mandated a 17 percent reduction in emissions, two questions should be asked: (1) will a trade-off have to be made; and (2) if there is a trade-off, how is that discussed.

- When discussing a trade-off, how valuable one thing is relative to another must be considered. For example, would it be better to have two percent MTBE in 100 percent of gasoline or 11 percent MTBE in 25 percent of gasoline?

- When discussing a one percent benzene cap, flexibility is essential to ensure that the cap can be achieved. Things are done in the refining processes to create variability and the average should not become the new cap.

- More discussion regarding overcompliance of toxics reductions is needed.

- The data on the remediation and treatment of Santa Monica wells before RFG (pre-1990) should be examined.

- It was recommended that a discussion on inventory management would be useful to include. However, because EPA has no authority on ASTs or unregulated USTs, there is no authority to require states to impose a requirement of inventory management. In response, it was commented that there may be other ways to achieve the goal of inventory management.

- Three items for consideration were noted: (1) even if MTBE is banned tomorrow, questions surrounding MTBE and its use will continue; (2) there is a case to be made for gasoline products and proper stewardship of those products; (3) it can be envisioned that more ethanol use will be seen and, therefore, inventory management and early leak detection programs will be useful for those situations as well. As a result of these considerations, the Panel recommendations should not be tied only to MTBE. There are many things that needed to be done with the fuels programs prior to the use of MTBE, and this is not an inappropriate time to take the opportunity to address some of these issues.

- Regarding the recommendation for prospective data, a look at practical public health impacts over time, and as a result of changes implemented, should be investigated.

- Whatever is done to enhance water protection should be linked to MTBE. The options are written as if there is a gasoline problem, when there is actually only an MTBE problem. Any recommendations must be made MTBE specific.

- The nature of gasoline will not be changed overnight; any changes that must occur will take time.

- A strong set of recommendations should be written for keeping all products in USTs out of the groundwater. The best possible tank protections should be designed. The entire universe of how to prevent releases into groundwater should be considered and then calibrated to correspond to any other recommendations; however, the Panel must first determine, define, or identify that universe.

- Inventory management is not an attempt to dismiss the effects of MTBE.

- The question of whether MTBE will be allowed in gasoline or not must be answered.

- It is inevitable that more ethanol will be used. But, even if the Panel recommends removing MTBE from the fuel, it would be very irresponsible to not take steps to prevent releases in a better way than is currently being done.

- The Safe Drinking Water Act (SDWA) requires only major sources to be monitored for MTBE, Should implementation of programs be broadened?

- It was noted that a test facility conducted a test with rubber duckies in a pool to determine the impacts of two-stoke versus four-stroke engines. The results showed that the duckies run with the two-stroke engines in the pool turned very black, while those that ran with the four-stroke engine were fairly clean.

- It is not apparent that California is not moving to four-stroke engines. However, there is not much of a problem because the nature of reservoirs (which are very large) allows the emissions to be flushed out. Furthermore, regarding public perception, if a large reservoir is taken out of service as a result of two-stroke engine use, huge amounts of public attention will result.

- There are regulations being written by EPA, which will be implemented next year, that will reduce emissions from two-stroke engines, but will not reduce spills of gasoline. However, there are regulations coming out in California that will require spill proof cans to be used.

- Surface water impacts (and the differential of going from 11 percent to 1-3 percent to zero percent MTBE) is a dimension that should be included in the list of recommendations.

**Typical Fuels and Standards**

Dave Kortum (EPA) began his presentation by stating that there is a problem with comparing the California Phase I Federal RFG program and the Phase II Federal RFG program because they use different metrics to measure the emissions benefits. Therefore, Mr. Kortum provided a chart (see attached) that attempts to look at various fuel formations of the programs and compare them using the same metric. The model used for comparing all the fuels is the Phase II complex model. For comparison purposes, the chart provides data for conventional gasoline pre-RFG as the baseline. The chart compares "actual" phase I summer (VOC-controlled) RFG properties and performance estimated from 1998 RFG Compliance Surveys with the averaging standards for Federal RFG Phase I, Federal RFG Phase II, and California RFG. The Federal RFG Phase I actual data are based on retail gasoline surveys conducted by EPA. EPA feels confident that these figures reflect good statistical data and

provide a good view of what the programs actually look like. Mr. Kortum noted that actual numbers cannot be provided for Federal RFG Phase II because the program does not start federally until next year. The emissions reductions data at the bottom of the chart are all calculated using the same model in an attempt to compare emissions reductions of the fuel parameters specified. Mr. Kortum also noted that, in the case of actual fuel for Phase I Federal RFG, much better results are seen than the theoretical fuel that just meets the standards, especially in regards to toxics benefits. This can most likely be attributed to the fact that fuel makers want to ensure that they are in compliance and, therefore, make fuels that are better than the required standards. In Federal RFG Phase II, with the exception of $NO_x$, the numbers are much closer to the California standards.

Next, Mr. Kortum provided a second chart that added figures for non-oxygenates in California. These data were obtained mostly from Chevron and the MAPCO report. From these data it can be determined that the lack of oxygenates drives aromatics down. Mr. Kortum noted that most fuels represent a composite picture (both premium and regular), and because the fuels cannot be separated out by grade, the chart assumes a consistent grade across fuel parameters except non-oxygenates.

***Panel Discussion***

- If the Federal Phase II sulfur is dropped down to the Tier II level, there is no substantial impact on $NO_x$.

- Benzene and aromatics are both dominating factors in terms of toxics in the results for the example of RFG Phase I where sulfur, aromatics, and benzene are all changing.

- Regarding toxic models, neither model accounts specifically for MTBE emissions; the toxics modeled are only those specified in the Clean Air Act.

- In this analysis, an increase in the presence of zylene or toluene would appear as an increase in benzene; the model illustrates what happens to benzene as aromatics increase.

- The benefits of moving from RFG Phase I to RFG Phase II in terms of cancer reduction are based on using the complex averaging standard. Regarding the previous discussion of the air quality benefits of an actual fuel being greater than the model predicted, how to maintain that and allow flexibility if the oxygenate requirements are changed must be discussed.

- The Federal Phase I RFG program is clearly ten percentage points better than it had to be. Therefore, one conclusion for Phase II is that should be a ten percent toxics reduction, which is also translated into benzene and aromatics levels.

- Regarding the quantification of benefits, EPA conducted a cost-benefit analysis when the Clean Air Act was promulgated. If a standard is set, industry has to do many things to produce compliant gasoline, which translates into significant costs.

- Chevron provided data on a fuel containing no oxygenates that has better toxics performance than Federal RFG Phase I. Regarding whether this a realistic fuel, it was noted that it is not clear how that fuel was produced. Chevron attempted to model all California RFG refineries based on cost.

- It is important to remember that Mr. Kortum's study looks at only one gasoline hypothetical blend; however, every refinery makes at least four types of blends (e.g., premium, regular, RFG, and conventional). It is not clear what blend or combination of blends is reflected in the data included in the chart provided by Mr. Kortum; therefore, it is not possible to determine what the toxic reductions would be.

- It is clear that over the past six years the refining industry has become better at blending fuels. However, the question of maintaining the reductions when the oxygen is removed must be addressed.

- In response to a question regarding whether there is something in the Phase II model that pushes industry towards overcompliance, it was noted that it is nearly impossible to find a fuel that contains the required oxygenate and just meets all three standards. When the VOC and $NO_x$ standards are met, there will always be toxics overcompliance because so much oxygen is added.

- Concern was expressed regarding the methodology used to produce the data depicted in the charts presented by Mr. Kortum. It appears as if the simulation was sorted to identify overcompliance; however, the entire population must be included.

- In response to a question regarding the extent to which all aromatics are created equally, it was noted that in the model they are all created equal and the aromatics fraction is not separated out. However, in the real world, there are clearly different aromatics that will have toxic differences.

- The complex model handles evaporative emission in the same way that it handles all emissions. It looks at the fuel parameters and how each emission is affected separately.

- When comparing California RFG to the Federal Phase II averaging standard, the primary difference is that the reduction in sulfur provides an increased toxic benefit.

**Reformulated Northeast U.S. Gasoline**

Mr. Campbell provided a brief presentation that addressed what would be done in the Northeast with no oxygenated gasoline (e.g., what would be substituted in the place of oxygen). Mr. Campbell reiterated that it is important to remember that most refiners make at least four types of gasoline, usually six to eight types. Mr. Campbell explained that the situation assumes summertime RFG, not conventional gasoline, at a constant volume and constant octane. He stated that currently, premium gasoline comprises approximately 25 percent of the total volume and regular gasoline comprises about 75 percent of the volume. The situation also assumes the production of 150,000 b/d of total RFG and 100,000 b/d of total conventional gasoline, which is approximately the split made in the Northeast refineries. Mr. Campbell stated that, given this information, it is Sunoco's opinion that it would be possible to make a gasoline that would meet the standard. The net change equals –21,000 million b/d of MTBE, +7,000 million b/d toluene, and +14,000 million b/d of alkylate. Mr. Campbell explained that the feedstock for MTBE is butylene. Therefore, MTBE plants could be converted to alkylate plants because the difference in the process only involves switching the balance of hydrocarbons. However, even this conversion would cost millions of dollars and Sunoco is unique because they have a facility that already exists. This solution would be dramatically different from refinery to refinery and the costs involved may result in some refineries determining that a conversion is not worth the effort.

***Panel Discussion***

- Mr. Campbell stated that he would consider sulfur removal to be a high cost conversion, and he would expect a conversion involving MTBE to be less.

- Mr. Campbell stated that the length of time needed to complete such a conversion would vary from refiner to refiner. It also depends on permitting processes. Before industry begins any changes, they must have certainty that the law will not change. Once legal certainty is known, it would take approximately four to five years to complete the conversion.

- Concern was expressed regarding the subtlety of the necessity that adding toluene is only true for premium gasoline.

- Although Mr. Campbell's exercise is a useful analytic tool, the need to balance economics must also be considered. Economic balancing, which will likely be used by most refiners, may produce a different endpoint.

- Although price cannot be predicted, steep changes in cost result from new construction or conversions.

- Mr. McNutt stated that a DOE conducted analysis concluded that there would not be a drastic price differential with or without the oxygenate mandate; approximately one cent per gallon.

- The problem with maintaining the mandate and replacing MTBE with ethanol in the Northeast is that the refiners do not know how to blend the fuel down to the RVP requirement.

- Converting from an MTBE to an ethanol mandate would result in an approximate 4 cent increase per gallon in price. This amount is the cost to the consumer and does not account for the subsidy. Decreasing sulfur content may be a potential cure to remedying the effects of increased RVP, effects and should be done consciously.

- It is important to remember that the issue of removing oxygenates from gasoline involves a massive change in industry that has a terrible set of economics behind it. When considering a change to private investors, it is crucial to remember that they are looking to make a return on their investment. As a result, it is possible that some of the current players in the refining industry may disappear if they do not continue to make a large enough profit.

**Northeast States Pollutants of Concern**

Mr. Grumet presented four slides to demonstrate the pollutants of concern in the Northeast. Through a modeling exercise, the Cumulative Exposure Project demonstrated that there are about 30 toxics of concern, four of which are driving the risk in the Northeast states: acrolein, benzene, 1,3-butadiene, and formaldehyde. Both benzene and 1,3-butadiene are produced predominately by the mobile source sector and, specifically by gasoline combustion. Mr. Grumet noted that the model does not look at the risk associated with diesel fine particles. The second slide presented by Mr. Grumet illustrated that the standard equals .12 mg/m3, which is the level at which one excess cancer risk per million people can be expected. The model reveals that there is a benzene problem. The third slide offered indicates that there is a clear downward trend (almost linear) of pollutants as one moves from urban areas to rural areas with modest industrial activity. This suggests that mobile sources are a dominant source of pollution.

Finally, Mr. Grumet presented a slide that showed that in New Hampshire from 1990 to 1991, the CEP predictions are of a factor of 2-3, which illustrates a very impressive modeling result. Mr. Grumet pointed out that, in general, it has been found that RFG areas have substantially lower benzene levels than non-RFG areas on the order of thirty plus percent. Air toxics are a legitimate health concern and diesel and gasoline combustion are primarily responsible for this risk. For more information on the treatment of these data, Mr. Grumet suggested that the Panel visit the Environmental Defense Fund's website at www.scorecard.org.

***Panel Discussion***

- The numbers presented represent ambient data; however, a key finding in California has been that hotspots (distribution centers for motor vehicles or freeways) can be 2-3 times greater than ambient data.

- There is a court order with a deadline in September for EPA to: (1) provide a clear risk assessment of air toxics impacts in urban areas, including diesel, gasoline, and air toxics from mobile sources; and (2) develop a regulatory effort to address any additional problems.

- It is important to analyze the future the growth of vehicles in the light-duty fleet in order to address whether emissions will increase substantially.

- In response to a question regarding EPA's views on the relative leverage the Agency will obtain in terms of vehicle control versus fuel formation strategies, it was stated that fuel is probably one of the most effective ways of addressing air toxics.

- Industry needs certainty; therefore, it is important to consider phasing and staging issues.

- It is important to amplify the notion that there appears to be consensus that some kind of "glide path" is needed. In addition, it is important to consider how a "glide path" is initiated and how does one objectively look back and analyze the data.

- The Panel should consider whether addressing the water quality problem with 11 percent MTBE in 25 percent of gasoline is worse than allowing two percent MTBE in 100 percent of gasoline given that it would just take five times as long to see the full weight of the problem. The issue of whether MTBE at lower levels is an appropriate solution must be addressed.

- The Panel is not balancing air and water quality impacts, but rather looking at environmental and economic impacts. Governor Davis in California justified his decision to ban MTBE by considering the environmental impacts. Mr. Buehler questioned whether some sort of liability mechanism should be considered (e.g., an add-on to the price of gasoline price) that would address the environmental and economic impacts.

- Why is MTBE still being considered as a potential solution when persistence and solubility are uncontrollable?

- It was questioned, what is the certainty that similar air quality benefits can be achieved without MTBE or benzene outside of California.

- For most risk issues there is a simple cancer metric that can be used, but for groundwater and others, there is no simple metric. Therefore, will it be possible to convince the public in 5-10 years that their resource has not been affected? From a risk assessment standpoint, public reaction must be considered.

- The wells have been closed for fear of even low levels of MTBE in water systems that cannot be detected. Public fear is so strong and irrational that a resource may be lost and gone that is not worth remediating. Must consider whether remediation is worthwhile if public fear still remains.

- It is important to focus on preventing the source from reaching the groundwater. In terms of leaking tank sites, source removal and triage were strongly suggested for the worst tanks.

- The core issues that need to be addressed relate to: (1) oxygen mandate versus flexibility; (2) air quality performance specifications; and (3) MTBE use (reduction or phase-out).

- If the original Panel charter is considered, the Panel must decide to ban or not to ban MTBE, which ultimately equates to picking a winner or loser (e.g., air or water). However, if the Panel considers flexibility, then there is no one winner or loser.

- Regarding risk perception, perceived risk is a viable economic consideration whether real or not.

- It was noted that, although there is a level of confidence in new tank regulations, EPA only controls and regulates half of the storage tanks; the other half of the storage capacity is not controlled by EPA.

- Regarding USTs and prevention, it is important to remember that there are other ways in which the product can be transported and stored. Therefore, USTs must not be the only prevention issue addressed.

- There are currently no data to indicate the rate of leakage from USTs that are in compliance. The weak data that exists indicate that the USTs in compliance still leak. In addition, there are no data on private wells.

- The process of banning a chemical in the U.S. is a very difficult process and a phase-out will ultimately lead to a ban. Therefore, it is important to understand how a ban fits into the larger context of the problem.

- In terms of banning, the application of the chemical would be banned. There may be other uses for MTBE that would not be banned. The Panel must consider whether or not prevention and remediation efforts can reduce the risk to acceptable levels.

- The regulated compounds that tend to travel the fastest are the BTEX compounds, but it has been found that they tend to anaerobically break-down and do not travel very far. Benzene does biodegrade and is, therefore, different than MTBE.

- There are health effects that cannot be circumvented and it would be a mistake not to put the recommendations in a health effects context. The issue cannot be explained to the public without such considerations.

**Panel Discussion on Financing Mechanisms**

It was suggested that MTBE be phased-out with a mandate, but also including a regulatory incentive. For example, a 10-20 cents per barrel surcharge that could be set aside to address treatment/remediation issues and bring market forces to bare on resolution of the problem. A Panel member noted that this approach allows industries the right to pay to pollute the water resources. It was also noted that it is important that this approach be considered in the context of a phase-out versus a non-phase out scenario of MTBE. If this approach is coupled with a phase-out, the refiner will still be responsible for leaks and the fund developed will not eliminate any current liability mechanisms, but will help get assistance to the impacted party. A Panel member noted that this approach did not work very well with the Superfund. It was questioned whether the use of this approach could be tied to performance benefits.

**Panel Discussion on the Oxygenated Fuels Program**

Mr. Greenbaum stated that the oxygenated fuels program started before the RFG program as a wintertime program that requires more oxygen to be added to the fuel (2.7 percent by weight oxygen), and is required only in CO non-attainment areas. The data indicate that, with the exception of New York and Los Angeles, all other areas that have this program use ethanol as the oxygenate, and Los Angeles will be moving towards using ethanol given the current decisions in California. In addition, New York is also being redesignated as an area that has attained the standard and, therefore, will not need the winter/oxy program in the future. Mr. Greenbaum asked the Panel to consider whether this is an issue that the Panel needs to discuss and, if so, what should be recommended regarding the program.

It was stated that the New York metropolitan area is comprised of three states, New York, Connecticut, New Jersey. If the Panel recommends any assertions that MTBE must be removed in every state except those three because they are required by mandate, an untenable situation is created for them politically. Those states would like to know that there is some effort to merge the two programs and that there is recognition that what is true for MTBE in groundwater in the summer is equally true for the oxygenated fuels program (OFP) in the winter. Therefore, any recommendations made regarding MTBE should be universal across both programs.

A Panel member stated that the real issue is all other gasolines, including conventional, will be a much bigger issue in the context of low sulfur, low toxic gasolines in the future. This will make the amount of MTBE being used in conventional gasoline look trivial in comparison. There is also a concentration issue that is unique to the conventional gasolines.

It was stated that there may be some apparent trends the midwestern and western CO programs that tend to minimize the concerns with this program, including: (1) many states are coming into compliance; (2) those that are not compliant have reduced their seasons significantly so that all the programs have become shorter; (3) in those areas where there is a continuing problem there is a tendency to increase the amount of oxygen required.

Mr. Greenbaum noted that while there may be some political difficulty surrounding what the Panel recommends regarding MTBE in RFG versus possible recommendations for the wintertime program, it appears that there are a number of areas that continue to use this program as one of the ways to achieve CO attainment and as part of their maintenance strategy. Therefore, the question is what effect does the decision regarding MTBE use in fuel have on the OFP.

**Concluding Remarks**

Mr. Greenbaum concluded the meeting by requesting that any additional comments on the issue summaries be submitted to Karen Smith, EPA, as soon as possible. In addition, the subgroup to be led by Carol Henry should convene to discuss the prevention/remediation/treatment summary. Mr. Greenbaum stated that he will attempt to develop a draft set of recommendations to be distributed prior to the next meeting and the Panel should expect to spend the majority of the final meeting discussing the draft document. Mr. Greenbaum requested that any further suggestions on recommendations be forwarded to him as soon as possible. The ultimate goal is to have a final report for presentation at the Clean Air Act Advisory Committee meeting scheduled to meet at the end of July. Mr. Grumet suggested that a paragraph be included at the beginning of the report that accurately describes the process used to produce the report and undertakes the terms of the debate.

**MTBE Blue Ribbon Panel Meeting Attendees**
**May 24-25, 1999**

| Name | Affiliation | Phone Number | Fax Number | E-Mail |
|---|---|---|---|---|
| John Lanau | Collier, Shannon, Rill & Scott | | | |
| Patrick Campos | Collier, Shannon, Rill & Scott | 202-342-8441 | 202-342-8451 | pcampos@colshan.com |
| Maureen Lewison | US EPA | 703-603-7143 | | lewison.maureen@epa.gov |
| Arlene Kabei | EPA Region 9 | 415-744-1027 | 415-744-1044 | kabei.arlene@epa.gov |
| Angeliki Mourtzikou | ICF Kaiser International | 703-934-3474 | 703-934-3968 | amourtzikou@icfkaiser.com |
| Rachel Sakata | US EPA | 202-260-2527 | | |
| Kevin Andersen | NPRA | 202-457-0480 | 202-260-3762 | sakata.rachel@epa.gov |
| Glenn Giacobbe | Lyondell | 610-359-5799 | 610-359-2581 | cnsgbg@arcochem.com |
| Charlie Drevna | Oxygenated Fuels Association | 703-841-7100 | 703-841-7720 | ctd@bellatlantic.net |
| David E. Holt | Information Resources | 703-528-2500 | 703-528-1603 | david.holt@motorfuels.com |
| Tom Wylie | Sunoco | 202-628-1010 | 202-628-1041 | thomas.l.wylie@sunoil.com |
| Shel Thompson | Sunoco | 215-977-3770 | 215-977-3902 | sheldon_l_thompson@sunoil.com |
| Steven M. Rothstein | Environmental Futures (BCI) | 617-443-1333 | 617-443-1301 | Steven_Rothstein@EnvFutures.com |
| Susan Field | Toyota Technical Center | 734-994-2058 | 734-994-5971 | field@ttc-usa.com |
| Tom Roberts | Van Ness Feldman representing Methanex | 202-298-1930 | 202-338-2416 | tcv@vnf.com |

**MTBE Blue Ribbon Panel Meeting Attendees**
**May 24-25, 1999**

| Name | Affiliation | Phone Number | Fax Number | E-Mail |
|---|---|---|---|---|
| Michael Macdonald | Methanex | 304-661-2673 | 304-661-2666 | mmacdona@methanex.com |
| Ryan Nayar | IRI | 703-528-2500 | 703-528-1603 | |
| Bruce Bauman | API | 202-682-8345 | 202-682-8270 | bauman@api.org |
| Bill Jordan | TX Natural Resource Conservation Commission | 512-239-2583 | 512-239-4808 | wjordan@tnrcc.state.tx.us |
| Dale Kardos | Dale Kardos & Associates | 202-466-3649 | 202-466-3722 | dkardos@ix.netcom.com |
| Bob Dinneen | RFA | 202-289-3835 | 202-289-7519 | wjordan@turccstate.tx.us |
| Art Wiese | API | 202-682-8547 | 202-682-8408 | wiesea@api.org |
| Mike Graboski | Col. School of Mines USDA | 202-694-5022 | 202-694-5665 | msgraboski@aol.com graboski@ean.ag.gov |
| Jamie Burnett | US EPA | 202-260-7749 | | |
| Lori Stewart | US EPA | 202-564-9035 | 202-565-2084 | stewart.lori@epa.gov |
| Thomas Harman | Inside Washington Publishers | 703-416-8596 | 703-416-8543 | |
| Hosein Shapouri | USDA Office of Technology and New Uses | 202-401-0531 | 202-401-0533 | hshapouri@ocg.usda.gov |
| Marc Meteyer | API | 202-682-8209 | 202-682-8209 | meteyer@api.org |
| Wayne Miller | Sunoco | 610-859-5519 | | wayne_miller@sunoil.com |
| Ann Farner Miller | Tosco | 203-977-1016 | 203-326-3144 | afarner@tosco.com |

**MTBE Blue Ribbon Panel Meeting Attendees**
**May 24-25, 1999**

| Name | Affiliation | Phone Number | Fax Number | E-Mail |
|---|---|---|---|---|
| **Robert Tardiff** | **Sapphire Group** | **301-664-8402** | | **RGT1@erols.com** |
| **Maria Bellos** | **Air Daily** | **202-775-0240** | | |
| **Glenda Booth** | **Senator Feinstein** | **202-224-3841** | **202-2284741** | |
| **Jenny Noonan** | **Senator Chafee** | **202-224-6226** | | |
| **Nick Economides** | **OFA** | **703-841-7100** | **703-841-7720** | |
| **Charles Walton** | **AMWA** | **202-331-2820** | | |
| **Ted Russell** | **GIT** | **404-894-3079** | | |
| **Gerald Karey** | **Oilgram News** | **202-383-2250** | | |
| **Pat Phillips** | **Business Publishers** | **301-582-4159** | | |
| **C. Watson** | **Dow Jones** | **202-862-9291** | | |